Section 5
Population, Growth and Land Use Projections

5.1 Growth Assumptions

The objective of this section is to estimate the population of Tijuana and Playas de Rosarito using the demographic components method, and based on the results of the 1995 and 2000 census, as well as other demographic data available for the period 1994-2000. Population projections for Baja California prepared by CONAPO (*Consejo Nacional de Población*) are used to estimate future fertility and mortality rates, as well as migration patterns, in order to develop future values for some demographic indicators. In addition, the assumptions made during the development of the population projections are described.

One important characteristics of Tijuana is its rapid population growth, attributed in great extent to immigration from other regions of the country.

Between 1995 and 2000 Tijuana observed an annual growth rate of 4.7 percent, while Playas de Rosarito grew at a rate of 7.2 percent. It is estimated that the dynamics of the population growth of Playas de Rosarito will resemble that of Tijuana in the future. In other words, the gap in the annual population growth rate between these two municipalities will narrow over time.

Fertility, mortality, and migration are the main factors affecting population growth. Fertility and mortality rates represent the "natural growth" of the population, while migration represents "social growth". These two types of growth have varied over time, causing variations in the population structure by age and gender, which in turn reflect a change in the dynamics of population growth.

One of the indicators used to measure fertility is the Global Fertility Rate (GFR), which indicates the average number of children per woman. This indicator has historically decreased for Tijuana and Playas de Rosarito, which might imply a decline in natural population growth. Between 1995 and 2000, the global fertility rate for Tijuana was 2.28 children per woman, while that for Playas de Rosarito was 2.79. These figures are smaller than the values observed for the period 1990-1995, during which the GFR was 2.54 for Tijuana and 3.28 for Playas de Rosarito. It is assumed that natural population growth will continue to decrease as the GFR decreases.

Mortality rates vary by age and sex. The mortality rate of Baja California is the lowest in the country. Life expectancy at birth is one of the indicators used to measure mortality rate.[1] In Tijuana, life expectancy at birth is 69.2 years for men, and 76.4 years for women. In Playas de Rosarito, life expectancy is 70.9 years for men and 75.8

[1] Life expectancy at birth is used to define the mortality rate and establish expectancy relations used to project population growth. This is the reason this indicator is taken into account and not mortality rates.

years for women. Once life expectancy reaches relatively high values, as those observed in Tijuana and Playas de Rosarito, its rate of growth will tend to decrease. Therefore, it is anticipated that a significant change in life expectancy will not take place during the planning period.

Migration is the most important factor affecting population growth, as well as the most difficult one to measure. The calculation of net migration by age group and sex is performed by means of the life expectancy method, which entails the use of a natural population growth rate to estimate a social growth rate.

Population growth in Tijuana between 1995 and 2000 was 219,228 people. It is estimated that natural growth accounted for 122,892 people in this period, while social growth was 96,336 people. This means that 44 percent of the growth in Tijuana in that period was a result of migration, demonstrating the importance of migration on population growth. In other states and municipalities social growth represents a smaller percentage of total growth, and may even be negative (i.e. emigration). Between 1995 and 2000 the Playas de Rosarito population increased 16,824 inhabitants, from which an estimated natural growth of 6,055 inhabitants and a social growth of 10,769 inhabitants are expected. This implies that migration contributes 64 percent of the total growth.

Once an analysis was made for each one of the demographic components to estimate the population growth, the following assumptions were made based on the Tijuana and Playas de Rosarito population:

- The fertility rate will continue to decrease until it reaches a GFR of 1.65 children per woman in the year 2020, according to CONAPO estimates for the State of Baja California.

- The mortality rate will continue to decrease to reach a life expectancy of 80.3 years for Tijuana, and 73.4 years for Playas de Rosarito by the year 2040.

- Migration rates will be 10 percent smaller than the rate observed for the period 1995-2000. This rate will be maintained at this level during the planning period. This assumption implies that migration will continue to play and important role in the growth of these municipalities and will never reach zero.

5.2 Population Growth Projections

5.2.1 Methodology

In order to develop population growth projections, a base population was established for June 30, 2000. The base population was based on information provided by the 2000 Census (INEGI). This assumption was agreed upon by the BTC of the master plan. The information provided by INEGI is found in detail by locality, municipality and by Basic Statistic Geographic Area (*Area Geográfica de Estadística Básica* (AGEB)). Notwithstanding, none of these units correspond to the service area of CESPT or the study area. Therefore, an additional analysis was made, which is presented later, in

order to estimate the population of the study area. The demographic projections are done at a municipal level.

Additionally, assumptions regarding fertility, mortality, and migration rates were developed and applied to the demographic models. The methodology used for the development of the population projections is described in Appendix L. Once the fertility, mortality and migratory rates were obtained, three growth scenarios were developed. The results of this analysis are described in the following section.

It is important to point out that the method used is not based on the projection of a population growth rate, as commonly done. Instead, the components method was applied, as described in Appendix L. The main characteristic of this method is the use of the three components of population growth: fertility, mortality, and migration rates.

5.2.2 Projections

Three population growth scenarios for Tijuana and Playas de Rosarito were developed, consisting of variations of the migration rate. Fertility and mortality rates are the same for all scenarios. It is assumed that the fertility rate will decrease until a rate of 1.65 children per woman is reached in 2025, after which time it will remain constant for both Tijuana and Playas de Rosarito. An increase in life expectancy is assumed until an average of 80.3 years for Tijuana and 73.4 years for Playas de Rosarito is reached in 2050.

Table 5-1 shows the results of the three scenarios.

In ***Scenario 1*** a low migration rate is assumed, with a decrease of 10 percent in relation to values observed for the period 1995-2000. Migration rates will be maintained constant.

Scenario 2 consists of a constant migration rate, and therefore results in a greater growth than scenario 1.

Scenario 3 includes a 10 percent decrease in the migration rate in every five-year period.

In addition to the three scenarios described above, Table 5-1 presents population projections developed by CONAPO, CONEPO, and population projections used by the State Water Services (COSAE) for Tijuana and Playas de Rosarito. These three projections are presented for comparison purposes, and they all represent “official” data (in the case of CONAPO and CONEPO), and it is recommended (in the case of COSAE) to use population projections.

Table 5-1
Population Projections 2000-2025

Tijuana	Scenario 1: Low Migration (Medium growth)	Scenario 2: Constant Migration (High growth)	Scenario 3: Descending Migration (Low growth)	COSAE	CONAPO	CONEPO
Tijuana						
2000[1]	1,210,820	1,210,820	1,210,820	1,210,820	1,210,820	1,210,820
2005	1,434,321	1,445,707	1,434,321	1,606,913	1,283,229	1,681,364
2010	1,650,293	1,677,540	1,637,591	1,907,693	1,424,426	2,334,769
2015	1,885,917	1,934,560	1,841,266	2,193,432		
2020	2,121,068	2,210,666	2,034,627	2,484,731		
2025	2,355,063	2,492,590	2,203,971	2,798,925		
Playas de Rosarito						
2000[1]	63,420	63,420	63,420	63,420	63,420	63,420
2005	82,901	84,220	82,901	103,401	69,867	105,517
2010	103,906	107,275	102,281	127,351	82,152	175,557
2015	128,973	135,380	122,959	146,426		
2020	157,938	169,288	144,044	165,872		
2025	191,066	209,046	164,043	186,847		
Total for Tijuana and Playas de Rosarito						
2000[1]	1,274,240	1,274,240	1,274,240	1,274,240	1,274,240	1,274,240
2005	1,517,222	1,529,927	1,517,222	1,710,314	1,353,096	1,768,881
2010	1,754,199	1,784,814	1,739,872	2,035,044	1,506,578	2,510,326
2015	2,014,890	2,069,940	1,964,224	2,339,858		
2020	2,279,006	2,379,954	2,178,671	2,650,603		
2025	2,546,129	2,701,636	2,368,014	2,985,772		

Source: Conapo, 1998; COSAE, 1998; Own Elaboration.[1]Statistics INEGI 2000.

The projections used by COSAE assume a linearly decreasing growth rate until it reaches a pre-established level. These projections do not consider each component of the dynamic of population growth. On the other hand, CONAPO projections have in the past underestimated growth in the study area, probably due to the fact that these projections are based on values valid for the country as a whole, but not necessarily for the study area. CONEPO projections are higher than the projections developed for this master plan.

CESPT and the BTC of the master plan, after considering different factors and evaluating the different scenarios, chose the medium projection (Scenario 1, low migration). The main consideration was the fact that the migration rate observed in the region during the last ten years has been significantly high, and that this rate will not likely continue at this level. The three scenarios are presented graphically in Figure 5-1. It can be observed that the low migration scenario (Scenario 1 –medium

growth) would continue the growth trend of the last 20 years. Due to the fact that the municipality of Playas de Rosarito was part of the municipality of Tijuana, there is no individual historic information available for each municipality. The population data that was used for the master plan, in the planning periods, is presented below.

Tables 5-2 and 5-3 summarize the municipal population projections and the 5-year period growth rates for each municipality, respectively.

Table 5-2
Total Population for the Municipalities of Tijuana and Playas de Rosarito

Year	Tijuana	Playas de Rosarito
2000	1,232,062	65,123
2001	1,270,092	68,679
2003[1]	1,349,711	75,790
2008	1,560,253	95,504
2013	1,787,878	118,946
2023	2,258,517	177,815
2030[2]	2,636,594	231,577
2040[2]	3,195,576	324,957

Source: Table 5-1.
[1]The year 2003 does not represent a planning period, but merely the year in which the plan was initially implemented.
[2] The years 2030 and 2040 were projected since represent planning periods for supply sources.

The growth rates associated with the five-year periods in which the planning period is divided are shown in following table.

Table 5-3
Tijuana and Playas de Rosarito: Growth Rates 1990-2040

	Tijuana	Playas de Rosarito
1990-1995	5.1	12.4
1995-2000	4.7	7.2
2000-2005	3.0	4.8
2005-2010	2.7	4.5
2010-2015	2.6	4.3
2015-2020	2.5	4.1
2020-2025	2.3	4.0
2025-2030	2.2	3.7
2030-2035	2.0	3.5
2035-2040	1.8	3.3

Source: master plan estimates

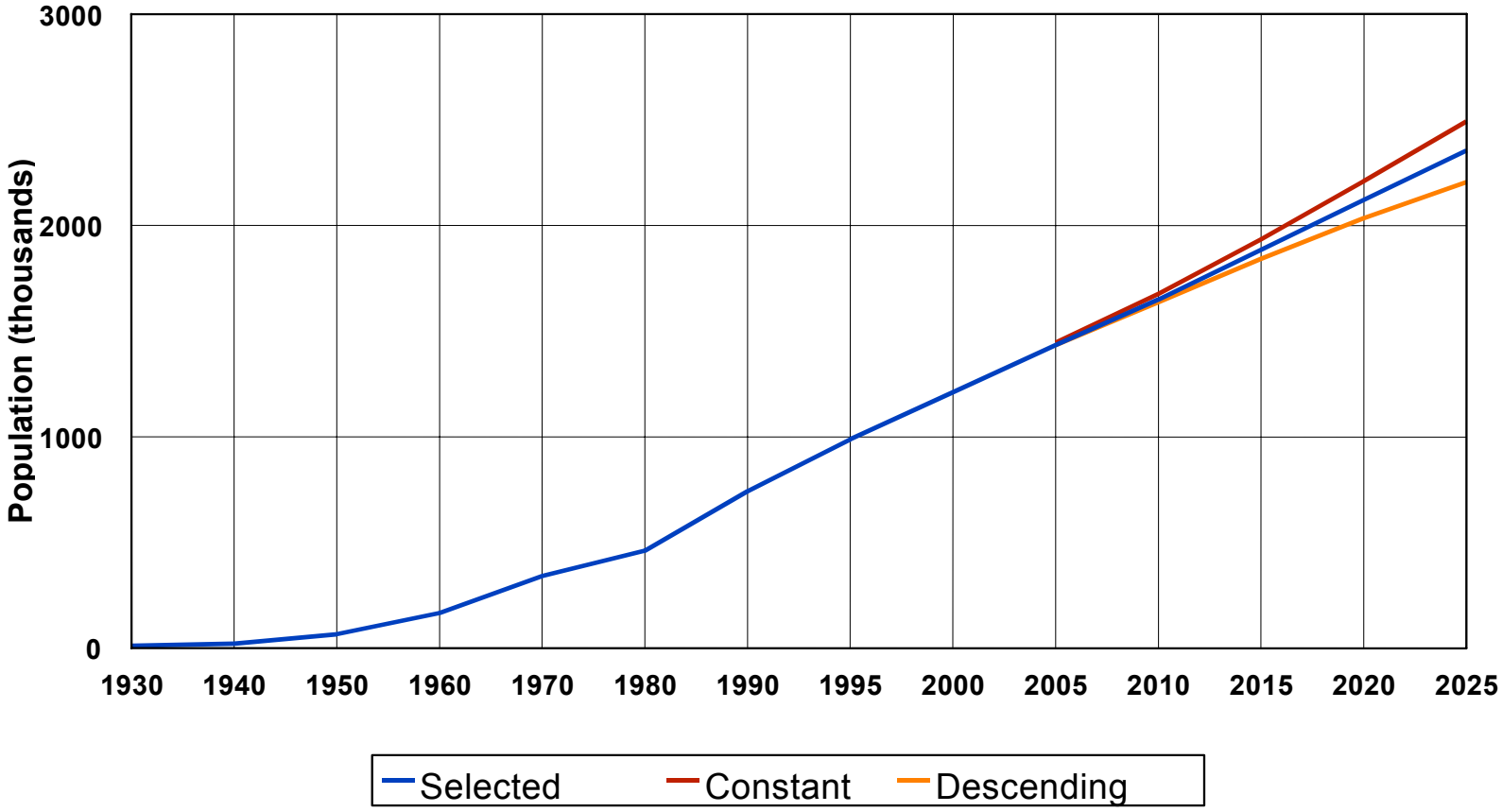


Figure 5-1
Total Projected Population in Tijuana from 1930 to 2025

Population of the Area of Study

The population projections previously discussed are for the municipalities as a whole. However, it is necessary to consider the concentration of the urban population in the metropolitan area conformed of the municipalities of Tijuana, Playas de Rosarito and other localities. These areas constitute the urban areas of the municipalities and they will be served by the operating organism. For the master plan, it was necessary to define the population that is to inhabit the study area for each planning period.

As part of the service area considered in the master plan, the towns of Primo Tapia, Puerto Nuevo, and Santa Anita, which are relatively large and separated from the urban area of Playas de Rosarito, are currently part of the CESPT service area. The location of these communities is shown in Appendix M.

It was assumed that the urban population of the city of Tijuana would represent 99.5 percent of the municipal total. This assumption is based on an analysis of historic population figures for the cities and the municipalities. For Playas de Rosarito, it is assumed that urban population will reach 95 percent of the municipal population. Population projections for the study area are presented in Table 5-4.

Table 5-4
Population of the Study Area per Year of Projection

Year	Total Municipal Population		Population in the Study Area		Total Population in the Service Area[1]
	Tijuana	Playas de Rosarito	Tijuana	Playas de Rosarito	
2001	1,270,092	68,679	1,263,742	66,756	1,330,498
2008	1,560,253	95,504	1,552,452	92,830	1,645,282
2013	1,787,878	118,946	1,778,939	115,616	1,894,555
2023	2,258,517	177,815	2,247,224	172,836	2,420,060

5.3 Economic Growth Projections

Economic growth projections are important to estimate future industrial and commercial water consumption rates. Water demand projections are described in section 6.

Economic activity in Tijuana and Playas de Rosarito revolves around tertiary sector activities (commerce, tourism, etc.), as shown in the composition of the economically-active population (EAP). In 1998, 56 percent of the EAP of the area was employed in this sector. Appendix N presents a discussion on the employment composition of the commercial and industrial sector, as well as on considerations of the North American Free Trade Agreement.

In 1998, 18 percent of the people employed in the tertiary sector worked in commercial activities, while 29 percent were employed in tourism.

The secondary sector also contributes to economic growth in the area, although at a smaller rate than the tertiary sector. The secondary-sector activity that has grown the most in the past decade is the export-oriented industry, commonly referred to as *maquiladoras*, which has played a major role in the economic growth of Tijuana.

Tijuana is the city with the greatest number of *maquiladoras* in the country. Currently, there are approximately 1, 500 manufacturing plants, from which approximately 600 are *maquiladoras*. Between 1980 and 2000 the increase in the number of plants was 8 percent, to a large degree as a result of the dependency on the U.S. economy, from whose economic cycles the behavior of the *maquiladora* industry is derived.

In 1990 employment in the secondary sector represented 37.3 percent of total employment. It is important to point out that *maquiladoras* represents nearly 40 percent of the total number of manufacturing companies, and 22 percent of industrial labor. On the other hand, non-*maquiladora* industry represents 60 percent of the number of plants, but only 7.16 percent of industrial labor. This illustrates the fact that non-*maquiladora* manufacturing industry is mostly composed of smaller plants.

The data concerning the municipality of Tijuana includes Playas de Rosarito data until 1995 in the information presented. From that year forward, Playas de Rosarito is an independent municipality.

5.3.1 Economic Forecast Model

The econometric forecast model of the economic and industrial growth of Tijuana and Playas de Rosarito is composed of a macroeconomic structure consisting of three interdependent equations. The first equation determines the gross value of production as a function of industrial, commercial and tourism growth. The second equation represents the international trade flow of the region as a function of the exchange rate, and historical growth of the Tijuana and Playas de Rosarito region. Finally, the third equation determines the quality of life of the residents as a function of the size of the population, government expenditure, and historical economic growth.

The three interdependent equations can be represented as:

1) $PRB_t = \gamma 11 + \gamma 12\ IME_t + \gamma 13\ COM_t + \gamma 14\ TUR_t + \gamma 15\ PRB_{t-1} + \varepsilon_{1t}$

2) $BC_t = \gamma 21 + \gamma 22\ TC_t + \gamma 23\ \Delta TC_t + \gamma 24\ PRB_{t-1} + \varepsilon_{2t}$

3) $ICV_t = \gamma 31 + \gamma 32\ POB_t + \gamma 33\ GP_t + \gamma 34\ PRB_t + \gamma 35\ PRB_{t-1} + \varepsilon_{1t}$

where:

PRB_t = Value of the gross production of the region

IME_t = Number of *maquiladora* establishments in the region

COM_t = Number of commercial establishments

TUR_t = Number of tourism service establishments

BC_t = Trade balance

ΔTC_t = Real exchange rate

ΔTC_t = Variable of the exchange rate before and after NAFTA

ICV_t = Index of quality of life

POB_t = Population

GP_t = Government expenditure

Appendix N presents the results of the economic model with respect to the coefficients.

5.3.2 Economic Growth Projections for Tijuana and Playas de Rosarito

The projection of the regional economic growth variable (i.e., the endogenous variable PRB_t or value of the regional gross production) is presented in the master plan in three scenarios. The first scenario illustrates the forecast without variations, according to the coefficients obtained in the regression and extrapolated to the year 2020. The second scenario introduces a change of $+2\sigma$ (2 times the variance of the forecast). Finally, the third scenario introduces a change of -2σ (2 times the variance of the forecast) maintaining the exogenous variables as constants (ΔTC_t, $TC_{t\,y}$ GPt).

Scenario 1. The PRB_t for the 2001 to 2020 period will have a growth rate of 3.4 percent, which is slightly smaller than the tendency of the last two decades (3.8 percent). This suggests that the expected smaller growth of PRB_t is motivated because the base year is affected by the recession U.S. Nonetheless, the growth will be sustained over time.

Scenario 2. The PRB_t for the 2001 to 2020 period is affected by a supposed variation in the PRB_t equal to twice the variance of the forecast. This assumption substantially affects the PRB_t , since the resulting growth rate is 3.9 percent, greater than the base scenario growth of 3.4 percent.

Scenario 3. The PRB_t for the period 2001-2020 is affected by supposing a contraction in the PRB_t of twice the variance of the forecast. A drastic fall in the growth rate of the product is observed. This would be the scenario in a permanent recession of the region of Tijuana and Playas de Rosarito.

Table 5-5 summarizes the economic growth projections for the study area.

Table 5-5
Projection of the Regional Gross Product of Tijuana and Playas de Rosarito, 1993-2020
Thousands of pesos at 1993 prices

	Tijuana			Playas de Rosarito
Period	**Moderate Growth**	**Low Growth**	**High Growth**	**Moderate Growth**
1993	16,592,426	16,592,426	16,592,426	952,571
1994	17,765,904	17,765,904	17,765,904	1,019,941
1995	17,181,532	17,181,532	17,181,532	986,392
1996	18,495,510	18,495,510	18,495,510	1,061,827
1997	20,712,535	20,712,535	20,712,535	1,189,107
1998	21,657,669	21,657,669	21,657,669	1,243,367
1999	22,694,105	22,694,105	22,694,105	1,302,869
2000	23,373,067	23,373,067	23,373,067	1,341,848
2001	24,052,028	24,052,028	24,052,028	1,380,827
2002	24,730,989	24,730,989	24,730,989	1,419,806
2003	25,409,950	24,139,453	26,680,448	1,458,785
2004	26,088,912	24,784,466	27,393,357	1,497,764
2005	26,767,873	25,429,479	28,106,267	1,536,744
2006	27,446,834	26,074,493	28,819,176	1,575,723
2007	28,125,796	26,719,506	29,532,086	1,614,702
2008	28,804,757	27,364,519	30,244,995	1,653,681
2009	29,483,718	28,009,533	30,957,904	1,692,660
2010	30,162,680	28,654,546	31,670,814	1,731,639
2011	30,841,641	29,299,559	32,383,723	1,770,619
2012	31,520,602	29,944,572	33,096,633	1,809,598
2013	32,199,564	30,589,586	33,809,542	1,848,577
2014	32,878,525	31,234,599	34,522,451	1,887,556
2015	33,557,486	31,879,612	35,235,361	1,926,535
2016	34,236,448	32,524,625	35,948,270	1,965,514
2017	34,915,409	33,169,639	36,661,180	2,004,494
2018	35,594,370	33,814,652	37,374,089	2,043,473
2019	36,273,332	34,459,665	38,086,998	2,082,452
2020	36,952,293	35,104,678	38,799,908	2,121,431

Source: Estimates obtained by DEE of COLEF, based on information of INEGI and SEDECO of Baja California

In summary, a growth rate of production at 3.4 percent is expected with a potential variation within the 2.6 and 3.9 percent range in the scenarios of recession and high economic growth, respectively.

5.3.3 Forecast of Industrial Growth in Tijuana and Playas de Rosarito

Once the economic growth, the composition of the production by sector, the industry type, and the growth rates for each of these sectors are obtained, it is possible to develop a forecast of the industrial growth of Tijuana and Playas de Rosarito.

The specialization by sector of the Tijuana and Playas de Rosarito region during the period 1995-2001 has experienced important modifications. Within the specializations by sector, commerce and tourism continue maintaining solid positions, while the manufacturing industry is expected to play an important role in the future.

The industrial forecast for Tijuana and Playas de Rosarito is shown and the production date (manufacturing) is divided among the different types of industry to analyze the behavior of the productive activities in Tijuana for the period of 2001-2020. This establishes a series of categories.

- A first group formed by activities with greater competitive advantages for its development in the region, such as the electronics and the electrical branches.
- A second group formed by construction and the non-metallic minerals that show global comparative advantages. These are losing dynamism in their growth rates.
- A third group formed by energy and ferrous metals that could become leader sectors in the future.

From a sector point of view, industry is gaining importance; therefore the projection implies a greater water demand in the future. Equally, at the branch level of industrial activity, three groups are observed: nucleus activities, sectors that have lost their dynamism, and those that with a potential to become leader industries. These also use water intensively. The analysis predicts a meaningful increase in the use of water by the industrial sector, proportionally to the residential use.

Table 5-6 presents historic information and gross domestic product projections of Tijuana by division. Table 5-7 illustrates the historic gross domestic product and projected solely for the manufacturing industry.

Table 5-6
Gross Domestic Product of Tijuana by Great Division 1993-2020
Thousands of Pesos at 1993 Prices

	Baja California	1 Agriculture, Forestry and Fishing	2 Mining	3 Manufacturing Industry	4 Construction	5 Electricity, Water and Gas	6 Commerce, Restaurants and Hotels	7 Transportation, Storage and Communications	8 Financial Services, Insurance, Real Estate and Rentals	9 Communal, Social and Personal Services
1993	16,592,426	544,232	39,822	2,936,859	771,548	393,241	3,980,523	1,499,955	2,890,401	3,535,846
2000	23,373,067	546,930	28,048	4,964,439	937,260	532,906	6,619,252	2,313,934	3,232,495	4,197,803
2005	26,767,873	610,308	32,121	5,583,778	1,057,331	607,631	7,647,581	2,655,373	3,752,856	4,820,894
2010	30,162,680	699,774	33,179	6,328,130	1,212,540	699,774	8,572,234	2,983,089	4,210,710	5,423,250
2015	33,557,486	761,755	33,557	7,094,053	1,335,588	768,466	9,570,595	3,281,922	4,691,337	6,020,213
2020	36,952,293	831,427	36,952	7,819,105	1,463,311	860,988	10,524,013	3,621,325	5,173,321	6,621,851

Source: Estimates obtained by DEE of COLEF, based on information from INEGI and SEDECO of Baja California

Table 5-7
Gross Domestic Product of the Manufacturing Industry of Tijuana by Division, 1993-2020
Thousands of Pesos at 1993 Prices

Period	Total Manufacture	I Food, Beverages and Tobacco	II Textiles, Clothing and Leather Industry	III Wood Industry and Wood Products	IV Paper, Paper Products, Printing and Editorial Houses	V Chemical Substances, Petroleum Derivatives, Rubber and Plastic Products	VI Non-metallic Mineral Products, Except Petroleum Derivatives and Carbon	VII Basic Metallic Industries	VIII Metallic Products, Machinery and Equipment	IX Other Manufacturing Industries
1993	2,936,859	619,677	97,797	210,573	90,455	143,025	229,662	22,320	1,244,347	279,002
2000	4,964,439	778,424	178,223	302,831	129,572	228,861	233,825	27,304	2,683,279	402,120
2005	5,583,778	1,149,142	184,823	331,118	179,798	274,164	372,996	40,203	2,530,568	520,967
2010	6,328,130	1,156,149	202,500	422,719	194,274	314,508	444,235	55,055	2,954,604	584,086
2015	7,094,053	1,158,459	273,830	418,549	195,796	319,942	432,737	65,975	3,551,992	676,773
2020	7,819,105	1,229,163	272,887	481,657	199,387	349,514	366,716	47,697	4,228,572	643,512

Source: Estimates obtained by DEE of COLEF, based on information from INEGI and SEDECO of Baja California
Note: This information is not available in detail for Tijuana and Playas de Rosarito

5.4 Forecast of Growth Distribution

5.4.1 Methodology

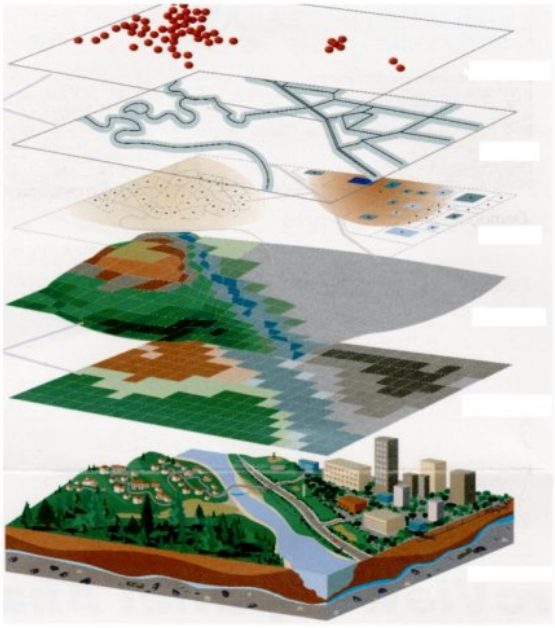
The master plan requires the population to be distributed geographically to estimate drinking water and sanitation demands by sectors of the study area, so that the needs of infrastructure for specific locations can be determined.

The basic methodology for the distribution of the projected population can be summarized in two fundamental steps, once the total population for the study area is determined:

- Re-densification: re-densify the current urban areas so that the population growth takes place within the existing urban area until reaching a maximum population
- Expansion of the urban area: determine the difference between the projected population and the population currently located in the urban area, and the distribution of this difference in areas outside of the current urban area.

The re-densification and urban expansion process should take into account factors related to land use plans and land characteristics, as well as urban infrastructure and population density. Because of this, the distribution process of population was performed based on the land use plans and criteria. The following graph conceptually illustrates this process.

Criteria for the expansion of the urban area



Existing infrastructure

Expansion of roads and highways

Land use established on municipal plans

Working meetings with IMPLAN

Growth scenarios

In the case of re-densification, the Basic Geo-statistical Areas (AGEB) for Tijuana and Playas de Rosarito established by INEGI, were used as an analysis unit for the spatial distribution of the population projections, as described in the section 5.2. Once the re-densification criteria to be used were agreed upon by the Municipal Institute of Planning of Tijuana (IMPLAN), the urban areas envisioned within the Urban Development Program of Tijuana (PDUCPT) were incorporated. Similarly, the criteria established by the Department of Urban Development and Ecology of Playas de Rosarito were incorporated. Based on this information, the maps that illustrate the future growth of the study area were generated. On the other hand, the guidelines established in the official standards documents were incorporated (COCOTREN, Corridor 2000, Urban Development State Plan, etc). Finally, the spatial distribution of the population was accomplished with the information obtained, after analysis and discussion in the methodology, and the criteria used by IMPLAN.

The process of re-densification was accomplished by means of a model based on AGEBS. The information of the census of 1995 and 2000 will be used to build a model that considers the re-densification of the AGEBS, as well as the growth of the population that results in the creation of new AGEBS or the modification of existing ones. Both datasheets have a keyword for each AGEB that is possible to identify in one and another.

This process cannot be automated. In one hand, the keys per AGEB in 1995 and 2000 are not similar in format; on the other hand, it is necessary to visually validate the information once the databases have been joined to avoid duplicating information. Once the previous steps have been accomplished, the following step is to establish a base population with the 1995 information and a final population in 2000 to apply the logistical growth model.

This growth model has been selected due to the fact that historical data is taken into consideration to establish the growth trend for each of the AGEB´S and because well defined limits for growth can be established. Once the saturation limit is reached, it is never surpassed.

Criteria to Establish T(0) and T(5)[2]

INEGI divides an AGEB when the population is larger than 5,000 inhabitants. This criterion is used because it is not possible to anticipate with accuracy which AGEB´S will surpass the limit between each census. In observing the information that corresponds to the years 1990, 1995 and 2000, it can be seen that between 1990 and 1995 there were many AGEBs that were divided and others that were created (Tijuana registered 197 AGEBs in 1990, 335 in 1995 and 351 in 2000; in Playas de Rosarito the figures are 16,45 and 41 respectively). Also, between 1995 and 2000, the number of AGEBs that were partitioned reduced considerably due to the fact that they can no longer be divided since the growth of the population is being distributed toward the outskirts. In this way, the procedure used was as follows:

[2] T(0) is the population per AGEB in 1995, considering the partitions observed in 2000; T(5) is the population per AGEB in 2000.

- The database with the information between 1995 and 2000 was accommodated according to the existing AGEBs in 2000. Thus, it was possible to distinguish clearly those that were new and those that stemmed from partitioning.

- To establish the population in T (0) and T (5) logic propositions were applied to then define the superior and inferior limits that the growth model would use.

The result of the model was the re-densification of the population within the area currently comprised by the AGEBS (see Figures in Appendix M).

5.4.2 Population and Land Use Projections

The procedure used allowed for the generation of a database with the population projections for the study area using the base year of 2001 and for the years 2002, 2004, 2008, 2010, 2013, 2023 and 2025 (see Table in Appendix M.)

The land use projection was developed from the official information available, provided by the Institute of Planning of Tijuana and from the Playas de Rosarito Urban Development and Ecology Department (see Figure of Future Land Use in Appendix M.) The integration of the growth tendencies and densification of the study area were provided by official organizations, and helped to design land use projection for the planning period of 2025 (see Figure of Actual Land Use in Appendix M).

5.5 Growth Projection by Area

The trend in the patterns of the spatial occupation, either by re-densification or by expansion of the urban area in the time frames of 2008, 2018 and 2023, will be determined by a strong interaction between Tijuana and Playas de Rosarito, as well as minor interaction between these two communities and Tecate, especially in the context of the Tijuana Corredor 2000. The proposal of the Tijuana Corredor 2000 offers ample development opportunities for economic activities and communications in the region. Other development plans, including the Coastal Corridor (COCOTREN), and the local and state plans presented in the Section 2-8, were considered for the spatial distribution of the population.

Urban growth patterns are based on the availability of roads and their closeness to the urban area, which in turn offers increased opportunity for the provision of basic services demanded by the population. Similarly, the areas expected to be integrated to the urban area were also considered.

Gaining control over growth is a major challenge that must be overcome to establish a real strategy for land use control and management. In reality, there has been little control in an area with high growth rates, which surpass the capacity of the municipal governments. An example of this is the existence of numerous neighborhoods in Tijuana that have been affected by soil subsidence and floods, while Playas de Rosarito presents similar flooding problems. These problems will increase as the urban area does and natural drain patterns are altered.

An important challenge in the study area is the creation inter-municipal mechanisms and coordination to address the upcoming control and order of the urban area of Tecate, Tijuana and Playas de Rosarito. A real coordination of the three municipalities would establish operational options for interaction and joint problems resolution, such as water supply, communications, public health, and educational deficiencies, to name a few.

The above considerations were the basis of the proposed re-densification assumptions made by official government entities. Based on the re-densification criteria, several scenarios were developed for growth of the urban area. (see Figures of the Population density distribution estimates per AGEB in 2008, the Population density distribution estimates per AGEB in 2018 and the Population density distribution estimates per AGEB in 2023 in Appendix M). Parting from the re-densification assumptions, the scenarios for the planning horizons contemplated by the master plan were concisely generated (see Figures of the Expansion of the Urban Area for 2008, 2013 and 2023 in Appendix M). For the areas that did not have land use or density information, state government information was used (Corridor 2000 and COCOTREN, both SAHOPE documents). In the specific case of the coastal area and the area constituting Corridor 2000, information was used directly from official SAHOPE documents.